Possum Point Power Station
Ash Pond E
Pilot Dewatering Test
Prince William County, VA
June 10, 2015

MORETRENCH

No one has seen more.™

Prepared for:
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1.0 INTRODUCTION

At the request of Glover Construction and Dominion Power, Moretrench American Corporation has completed a pilot dewatering test in Ash Pond E at Possum Point Power Plant in Prince William County, Virginia. The purpose of this test was to characterize the hydrogeologic properties of the fly ash in the pond, in order to evaluate the drainage characteristics of the ash.

This report summarizes:
1. Installation and aquifer testing of a representative array of wellpoints drawing from the ash.
2. Installation and aquifer testing of a deep well drawing from the underlying virgin soils beneath the ash. This was performed to evaluate the groundwater communication between the natural soils and the ash.
3. Qualitative evaluations of the stability of the fly ash (with test pitting) at various distances from the wellpoint system, prior to, and toward the end of, the pumping test.

It should be noted that the hydrogeologic characteristics of the ash could vary at other points in the pond not instrumented or monitored as part of this investigation.

1.1 Scope of Work

The following are documented in this report:
- The installation of twenty-one steel, self-jetting wellpoints (with conventional granular filter packs) in the ash pond, to be used for aquifer testing.
- The installation of a vacuum system to pump water from the wellpoints.
- The installation of five additional steel, self-jetting wellpoints (with conventional filter packs) at regular distances from the main wellpoint array, to be used as piezometers.
- The installation of one deep well in the ash pond, to be used for aquifer testing.
- The installation of four additional deep wells at regular distances from the aforementioned deep well, to be used as observation wells.
- The deployment of data loggers into each piezometer to record groundwater levels.
- An aquifer test using the wellpoint system, consisting of:
  - 24 hours of static groundwater/pondwater level monitoring before system operation.
  - Ten days of system operation, with groundwater/pondwater level and flow readings.
  - 48 hours of groundwater/pondwater level readings after system operation (recovery).
  - The measurement of individual maximum yields from each wellpoint before system operation.
- Installation of four clusters of tensiometers along the piezometer line, with one cluster located midway between each consecutive pair of piezometers, to measure soil suction at various depths below the pond surface.
- Subsurface exploration with a hand auger to locate the approximate depth of unstable ash prior to, and at the height of, system operation.
- A single well aquifer test on one deep well installed in the natural soils.

2.0 SITE DESCRIPTION

The Site is located within Ash Pond E of the Possum Point Power Station in Dumfries, VA. The site is approximately 5 miles Southwest of the Occoquian Bay. A satellite image of the site location is included in Appendix A.

3.0 FIELD METHODOLOGY

Field activities were carried out by Moretrench from April 27, 2015 through June 1, 2015, to perform the field work. The field procedures and methodologies used for these activities are summarized below. Data collected from these field activities are presented below and in the attached appendices.

3.1 Wellpoint Testing

3.1.1 Wellpoint Installation

Wellpoints were installed at the site between May 4 and 5, 2015. Twenty-one two-inch, self-jetting, steel wellpoints were installed on five-foot centers in a single, 100-foot line. Five two-inch, self-jetting, steel wellpoints were installed on ten-foot centers in a single, 50-foot line running approximately perpendicular to the previously mentioned wellpoint line, forming a “T”.

Once a steel wellpoint had been jetted to the appropriate depth, sand was immediately poured into the annulus surrounding the wellpoint. Mason sand was used.

Construction information for each wellpoint is provided below, in Table 1. A general site layout is available in Appendix A. Material cut-sheets are available in Appendix F.

Following installation, wellpoints were individually developed by pumping each wellpoint with a 2” trash pump.

3.1.2 Deployment of Data Loggers and Baseline Water Level Monitoring

On May 8, 2015, Moretrench began collecting groundwater levels in all piezometers. The purpose of this data collection was to determine baseline groundwater levels and observe fluctuations in groundwater levels with time.

Water levels were monitored using In-Situ Level TROLL 500 data loggers. These instruments recorded water levels every 60 seconds. The loggers were factory-calibrated to provide an accuracy of 0.1% full scale. Data from these instruments can be found in Appendix B. Note that an approximated specific gravity of 0.999 (clear water) was used in these measurements.

Table 1 Summary of Wellpoints Installed for Pumping Tests

Well	Depth to Bottom of Borehole (ft BGS)
WP-1	20.67
WP-2	20.25
WP-3	20.34
WP-4	20.34
WP-5	20.34
WP-6	20.34
WP-7	20.34
WP-8	20.34
WP-9	20.34
WP-10	20.34
WP-11	20
WP-12	19.92
WP-13	20.34
WP-14	20
WP-15	20.34
WP-16	20.5
WP-17	20.34
WP-18	19.75
WP-19	19.75
WP-20	20.42
WP-21	20.34
FFP-1	19.75
FFP-2	20.34
PZ-1	20.17
PZ-2	20.09
PZ-3	20.25
PZ-4	20.34
PZ-5	20.34

3.1.3 Installation of Tensiometers

Twelve tensiometers were installed along the piezometer line. Manufacturer and installation details are provided in Appendix F. The sensors were fully soaked in water prior to installation as per the manufacturer's recommendations. Additional lengths were spliced onto the tensiometer wires as necessary in order to increase their reach. Tensiometers were installed in clusters of three tensiometers, with one tensiometer from each cluster located as closely as possible to each of the following depths: 5ft, 10ft, and 15ft (Table 2).

Table 2 Summary of Tensiometers Installed for Pumping Tests

Cluster ID	Tensiometer ID	Approximate Distance to Wellpoint Line	Approximate Sensor Depth
Cluster 1	TS1-5	15	5 ft
	TS1-10	15	10 ft
	TS1-15	15	15 ft
Cluster 2	TS2-5	25	5 ft
	TS2-10	25	10 ft
	TS2-15	25	15 ft
Cluster 3	TS3-5	35	5 ft
	TS3-10	35	10 ft
	TS3-15	35	15 ft
Cluster 4	TS4-5	45	5 ft
	TS4-10	45	10 ft
	TS4-15	45	15 ft

3.1.4 Aquifer Testing

3.1.4.1 Yield Testing

The individual yield of each wellpoint was assessed prior to the pumping test. The wellpoints were test pumped with a 2" trash contractor's pump. Yields were determined by measuring the amount of time it took for the discharge from the wellpoint to fill a vessel of known volume. Prior to the commencement of the pumping test, this was performed immediately following development of each wellpoint.

3.1.4.2 Wellpoint Pumping Test and Recovery

Following the retrieval of baseline water level data and individual yield-testing, the steel wellpoints were connected to a vacuum header system. The system was connected to a pumping station which consisted of a "pump can" and a stand-alone vacuum pump. Operation of this system began on May 9, 2015 at approximately 9:30 AM and ended on May 19, 2015 at approximately 9:30 AM. Water levels in all piezometers were recorded by data loggers throughout this operation. Tensiometer data and system discharge volumes were manually read and recorded at least once per day. Following the shut-down of the vacuum wellpoint system, the data loggers were allowed to continue recording water levels as the groundwater recovered.

Data from these instruments is included in the attached appendices.

It should be noted that several open drainage trenches, within 120 feet of the wellpoints, were draining water from the ash concurrent with the pumping test. This may have affected the results of the testing.

3.2 Deep Well Test

3.2.1 Deep Well Installation

Deep wells were installed from the perimeter access road between April 29, 2015, and May 2, 2015. One four-inch, PVC well was installed within 50 feet of wellpoint line. Four additional four-inch, PVC wells were installed at varying distances from the aforementioned deep well.

Construction information for each deep well is provided below, in Table 3. Material cut-sheets are available in Appendix F.

Following installation, wells were individually developed by air surging.

Table 3 Summary of Wells Installed for Pumping Tests

Well	Depth to Bottom of Borehole (ft BGS)
DW-1	61.5
DW-2	59.5
DW-3	60.3
DW-4	57.5
DW-5	60.5

3.2.2 Data Logger Deployment and Baseline Water Level Monitoring

On May 22, 2015, Moretrench began collecting groundwater levels in all observation wells. The purpose of this data collection was to determine baseline groundwater levels and observe fluctuations in groundwater levels with time.

Water levels were monitored using In-Situ Level TROLL 500 data loggers. These instruments recorded water levels every 60 seconds. The loggers were factory-calibrated to provide an accuracy of 0.1% full scale. Data from these instruments can be found in Appendix C. Note that an approximated specific gravity of 0.999 (clear water) was used in these measurements.

3.2.3 Deep Well Pumping Test and Recovery

Operation of the deep well system began on May 26, 2015 at approximately 11:00 AM and ended on May 30, 2015 at approximately 11:00 AM. Water levels in all observation wells were recorded by data loggers throughout this operation. Tensiometers were read and recorded at least once per day. System flow was assessed via an automatic flowmeter. Following the shut-down of the deep well system, the data loggers were allowed to continue recording water levels as the groundwater recovered.

Data from these instruments has been made available in the attached appendices.

3.3 Geotechnical Exploration with Hand Auger

A 2 ¾" hand auger was used to locate the depth to unstable ash at several locations adjacent to the piezometer line, both before, and during, pumping. The approximate locations of these hand auger test pits are shown in Appendix A. Auger-holes were located approximately three feet off of the piezometer line. The location of unstable material was assumed to be the point where surrounding material would slough into the borehole upon removal of the hand auger. This "slough point" was measured by sounding the borehole 10 minutes after removal of the auger once wet material was encountered. Results are provided in Table 4, below. It should be noted that the depth to stable ash in a small borehole does not necessarily correspond to the depth to stable ash in an open excavation.

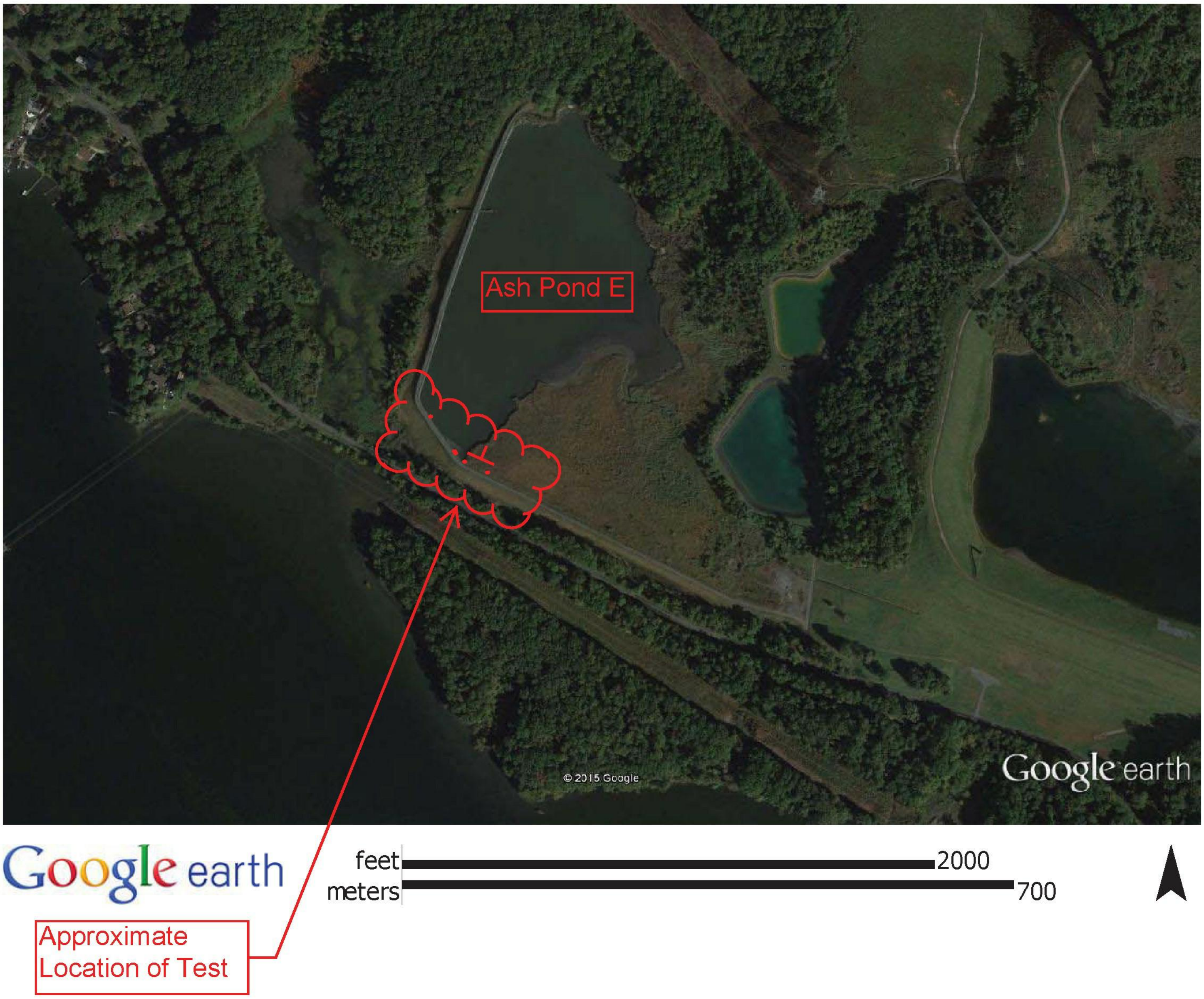
Table 4 Summary of Depths to Unstable Ash – Pre-Pumping

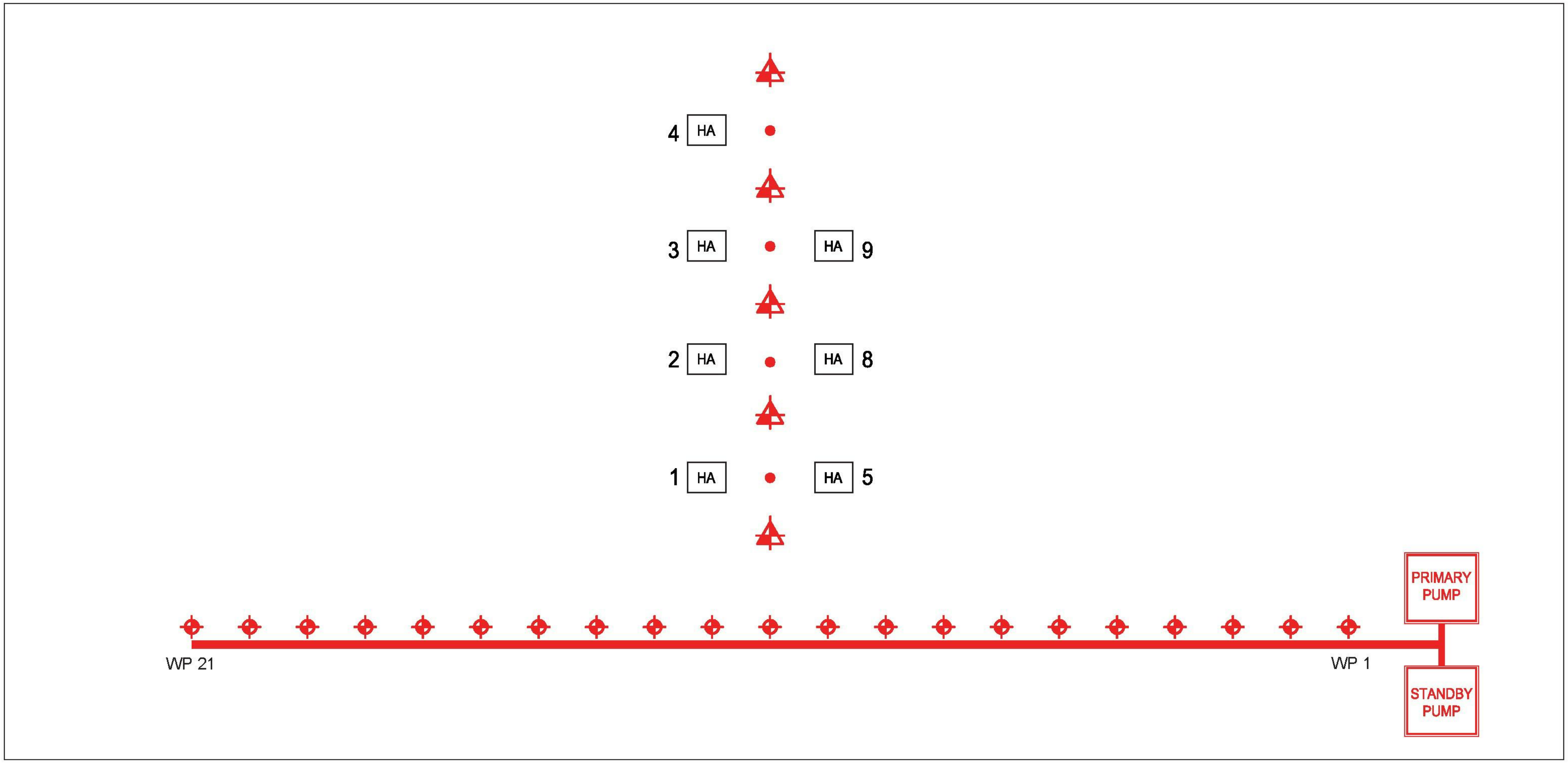
Auger Location ID	Approximate Distance from Wellpoint Line (ft)	Date	Auger Depth (ft BGS)	Slough Point (ft BGS)
HA 1	15	5/7/2015	7	6.5
HA 2	25	5/7/2015	7	6.5
HA 3	35	5/7/2015	7	6.5
HA 4	45	5/8/2015	7	6.5

Table 5 Summary of Depths to Unstable Ash – Near End of Pumping Test

Auger Location ID	Approximate Distance from Wellpoint Line (ft)	Date	Auger Depth (ft BGS)	Slough Point (ft BGS)
HA 5	15	5/14/2015	10	9
HA 8	25	5/17/2015	10	9.5
HA 9	35	5/17/2015	9	8.5

APPENDIX A
Drawings


Ash Pond E
© 2015 Google
Google earth
feet
2000
meters
700
Approximate
Location of Test



LEGEND:

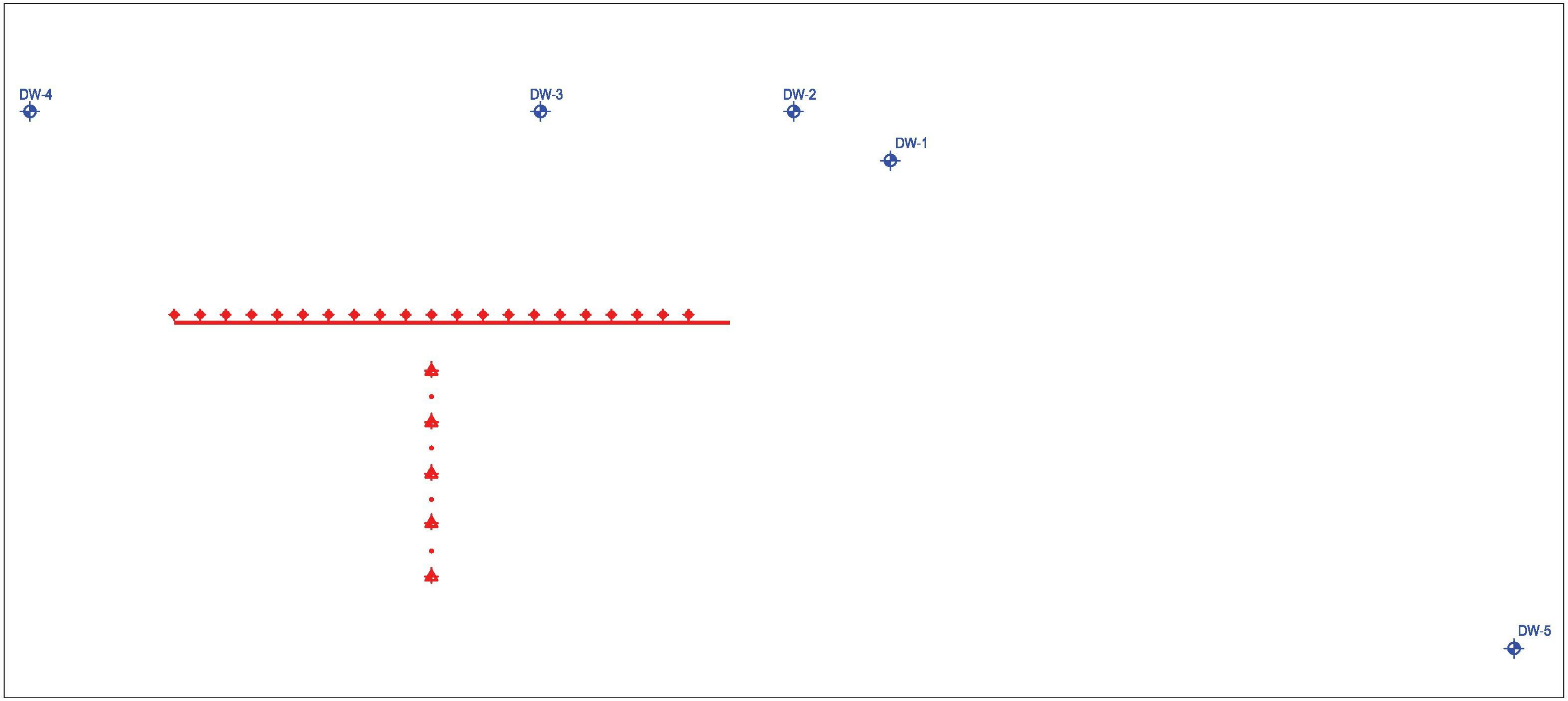
- WELLPOINT
- PIEZOMETER
- TENSIOMETER CLUSTER
FFP - FILTER FABRIC WELLPOINT
HA - HAND AUGER

POSSUM POINT

WELLPOINT PUMPING TEST LAYOUT

NOT TO SCALE

00011425



LEGEND:

- WELLPOINT
- PIEZOMETER
- TENSIOMETER CLUSTER
- DEEP WELL

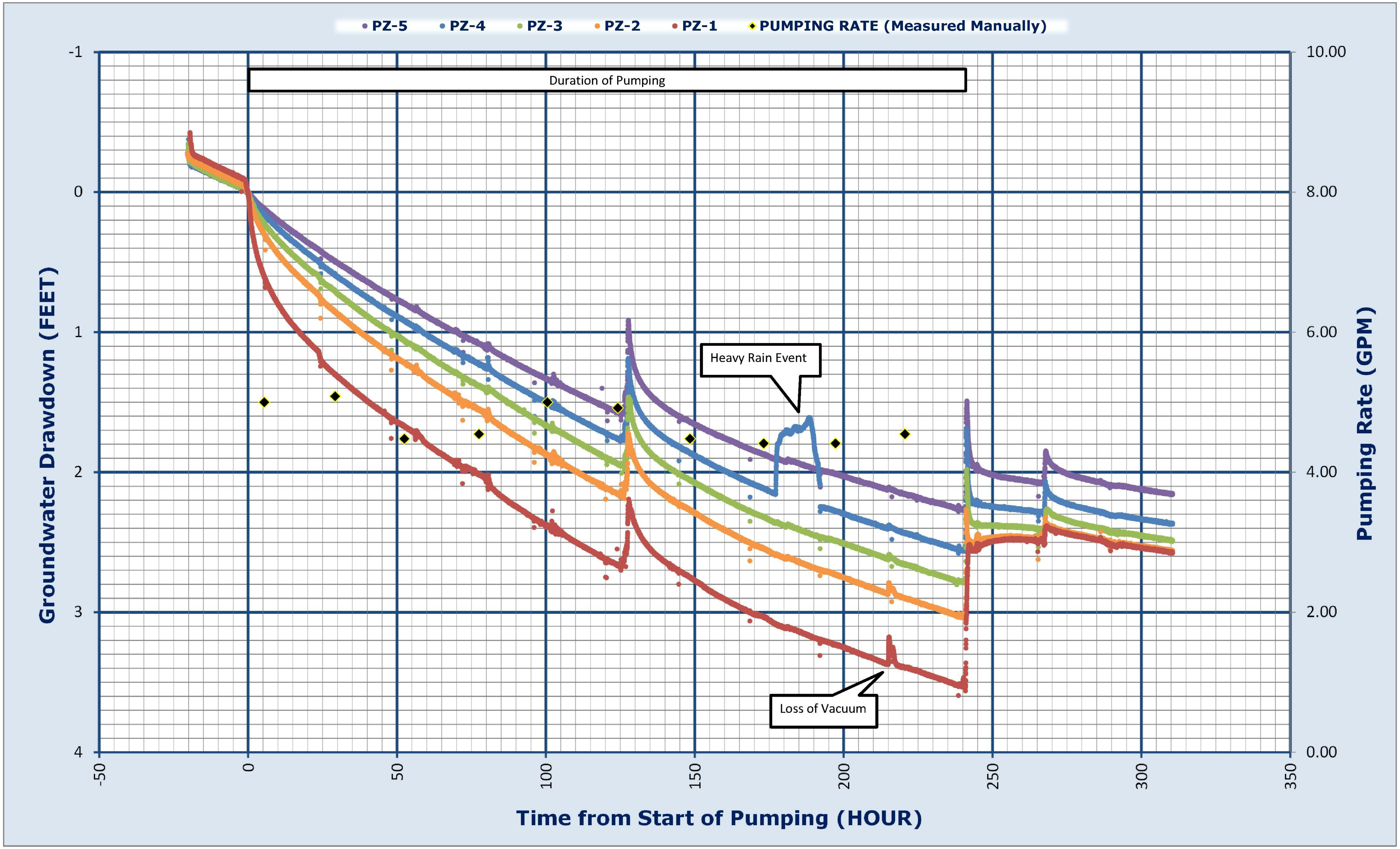
POSSUM POINT

DEEP WELL PUMPING TEST LAYOUT

NOT TO SCALE

APPENDIX B
Water Level Data Plots – Wellpoint Testing

Possum Point Pilot - Drawdown and Pumping Rate vs. Time - Wellpoint Pumping Test Full Data Logger Record



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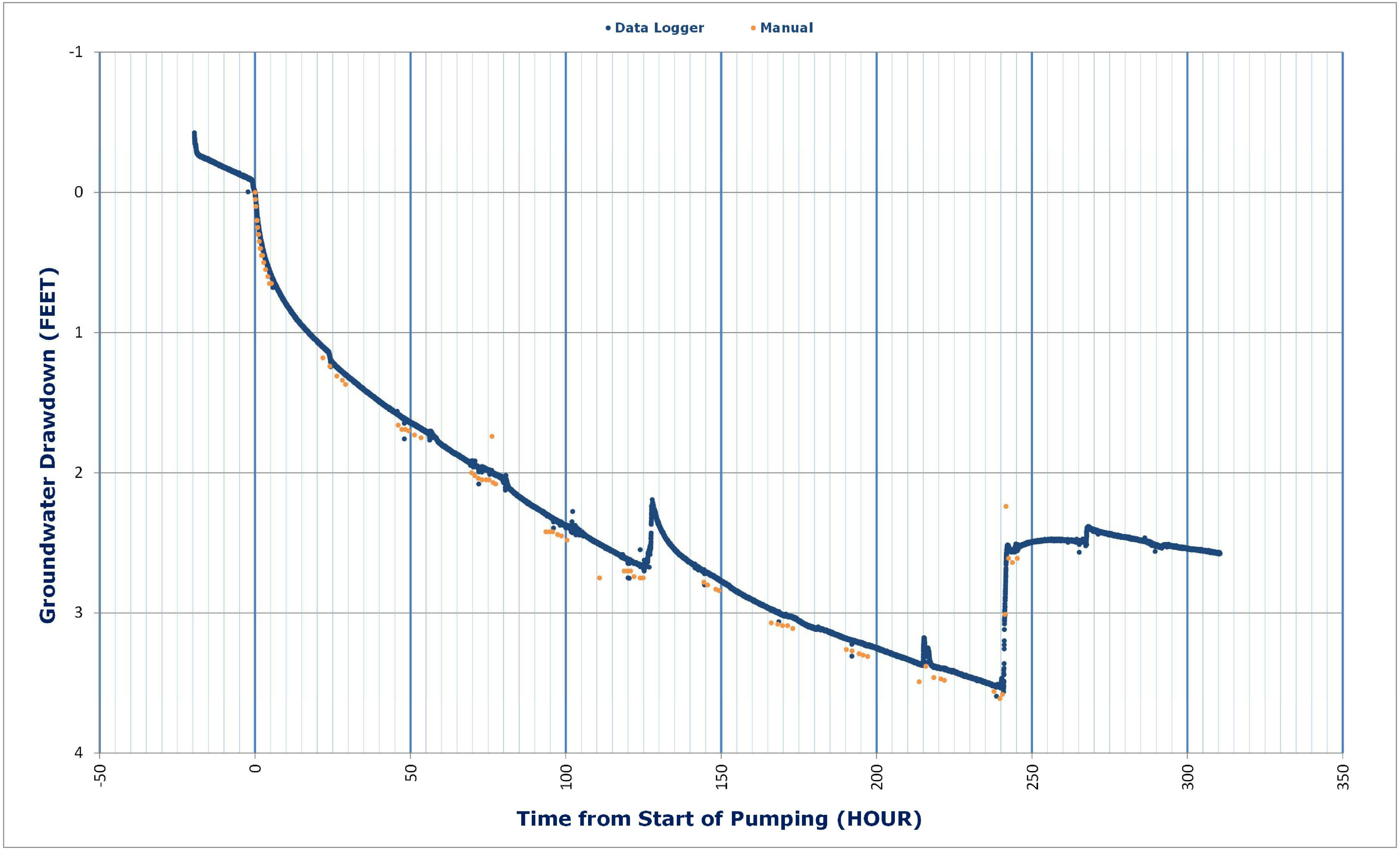
Possum Point Pilot - PZ-1 Drawdown vs. Time - Full Record



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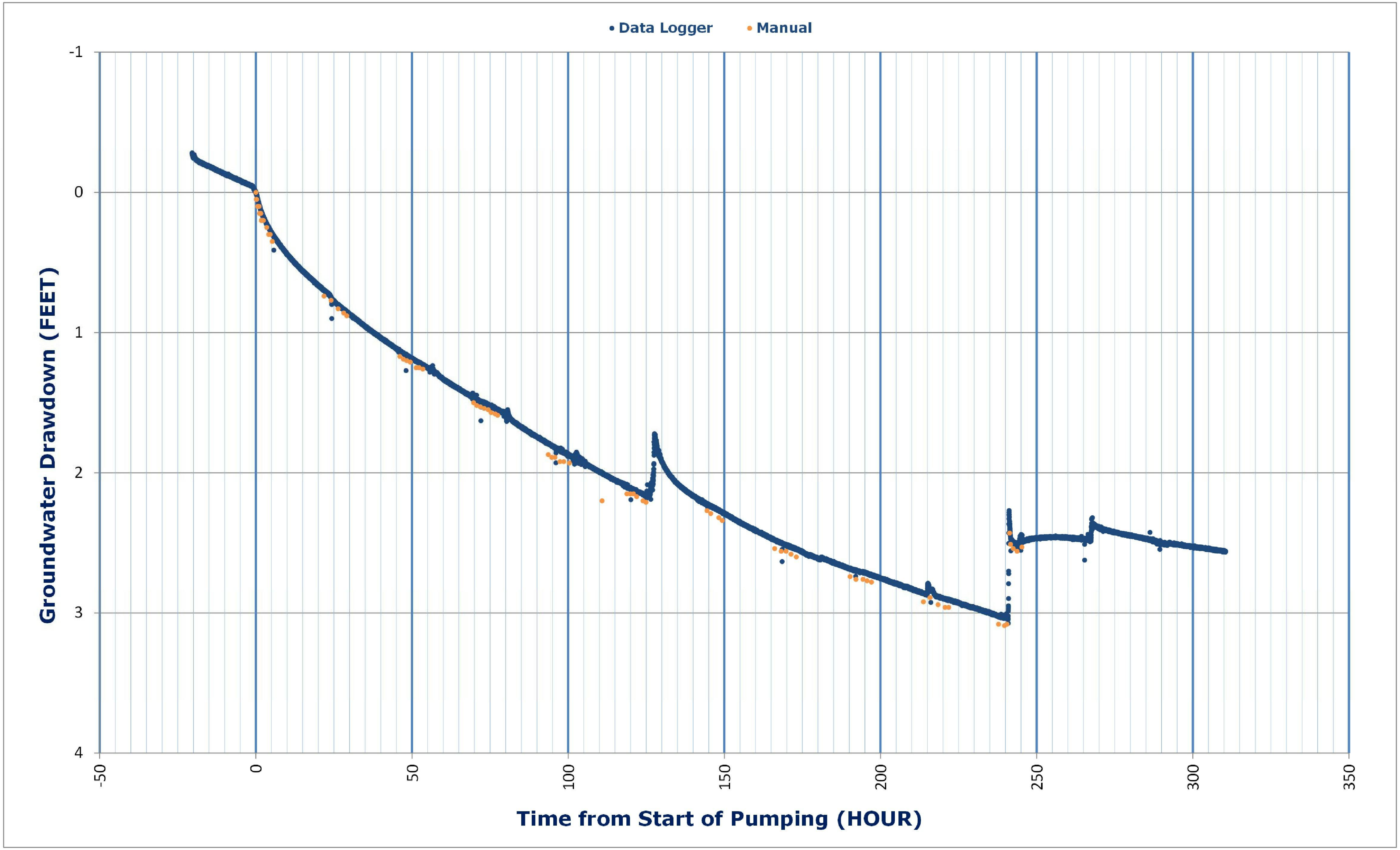
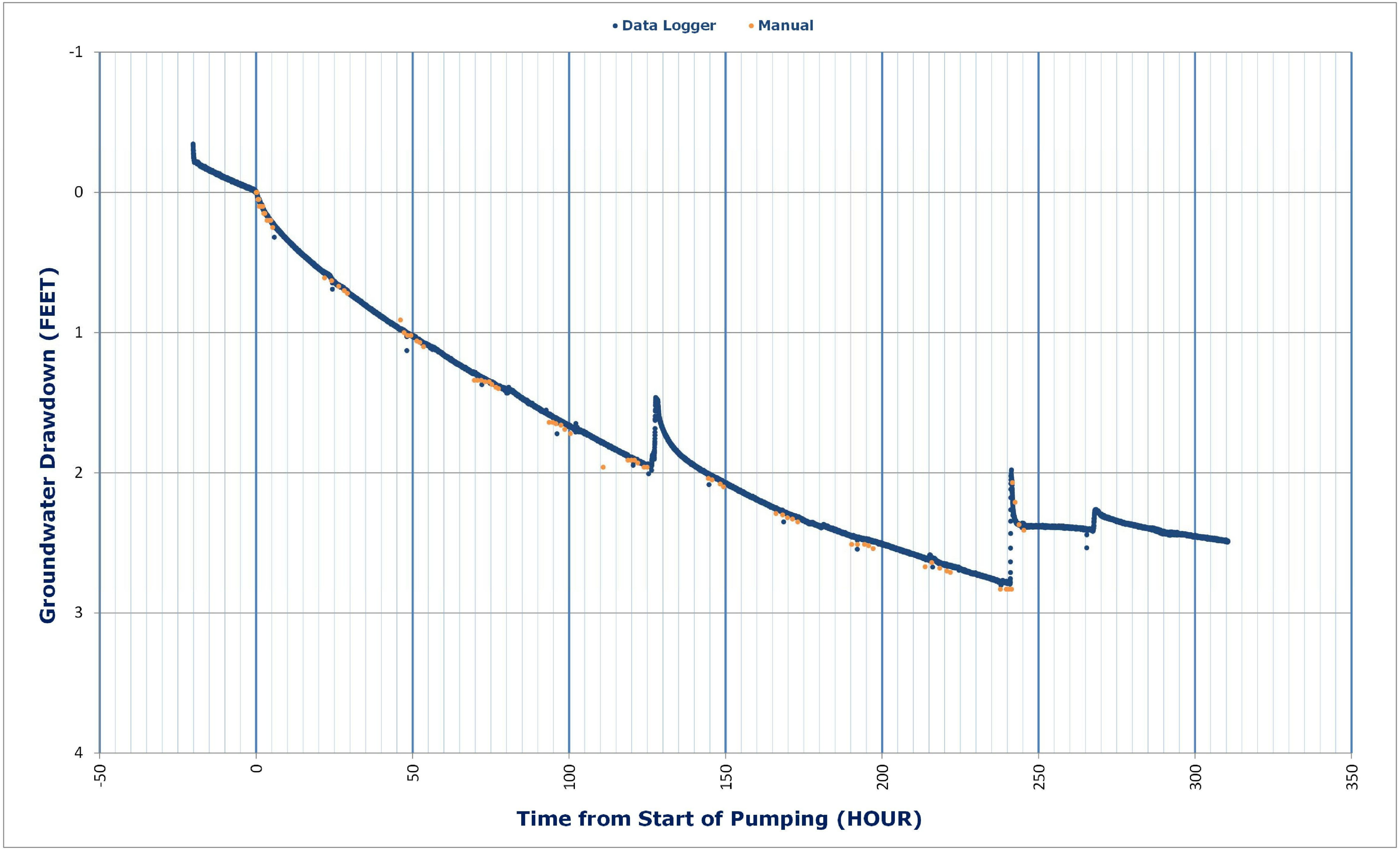
Possum Point Pilot - PZ-2 Drawdown vs. Time - Full Record



MORETRENCH

Possum Point Pilot - PZ-3 Drawdown vs. Time - Full Record



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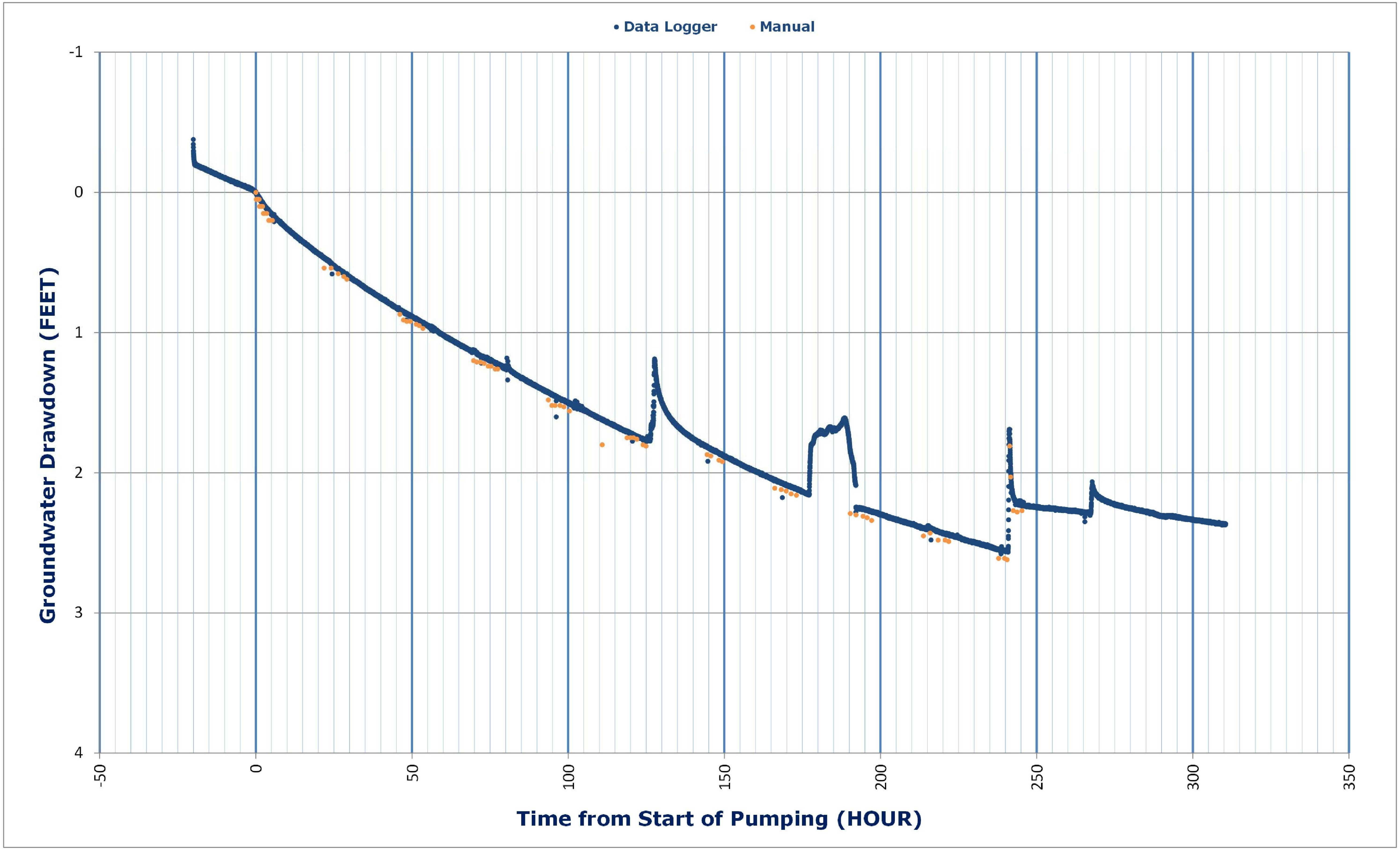
Possum Point Pilot - PZ-4 Drawdown vs. Time - Full Record



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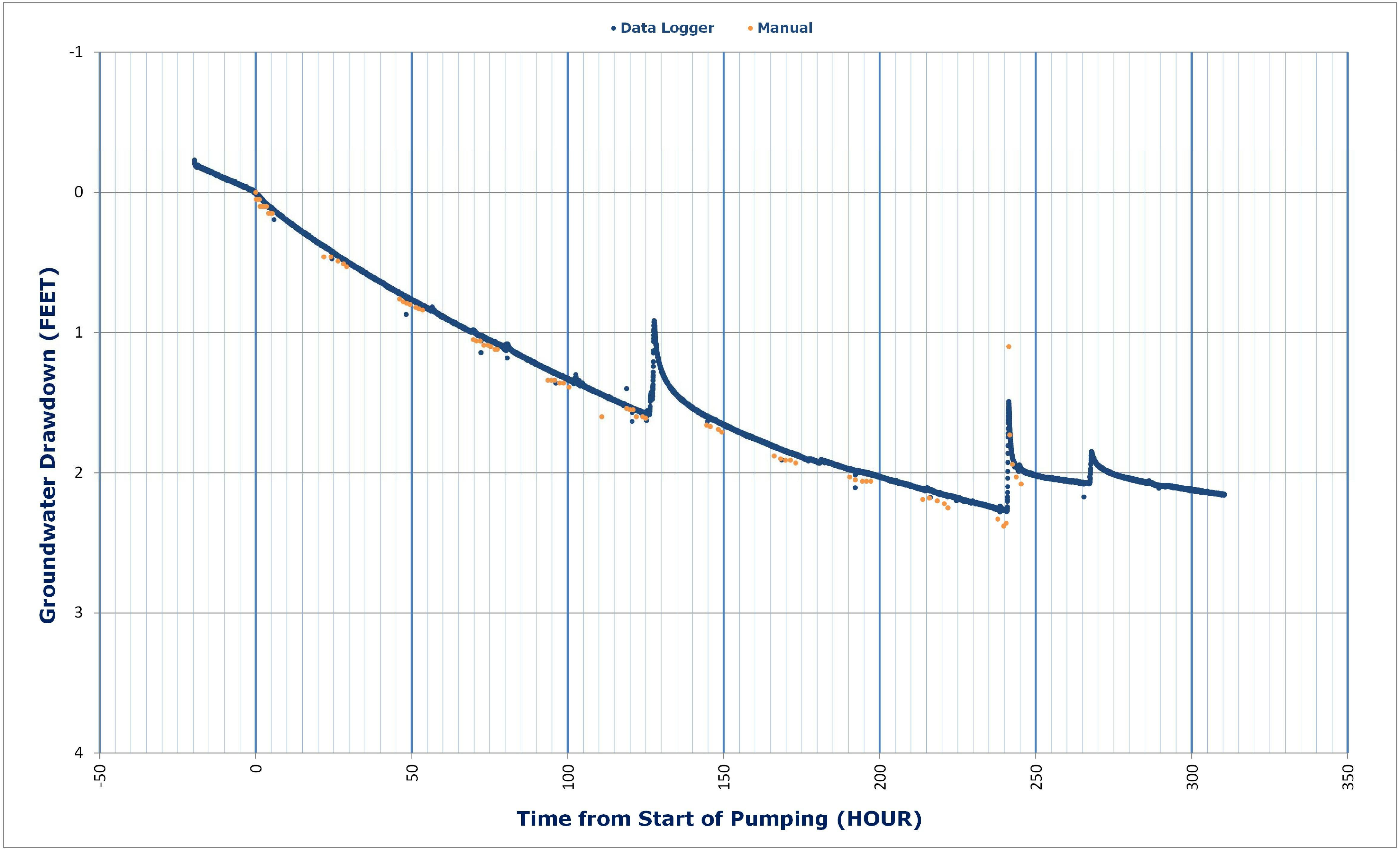
00011432

Possum Point Pilot - PZ-5 Drawdown vs. Time - Full Record



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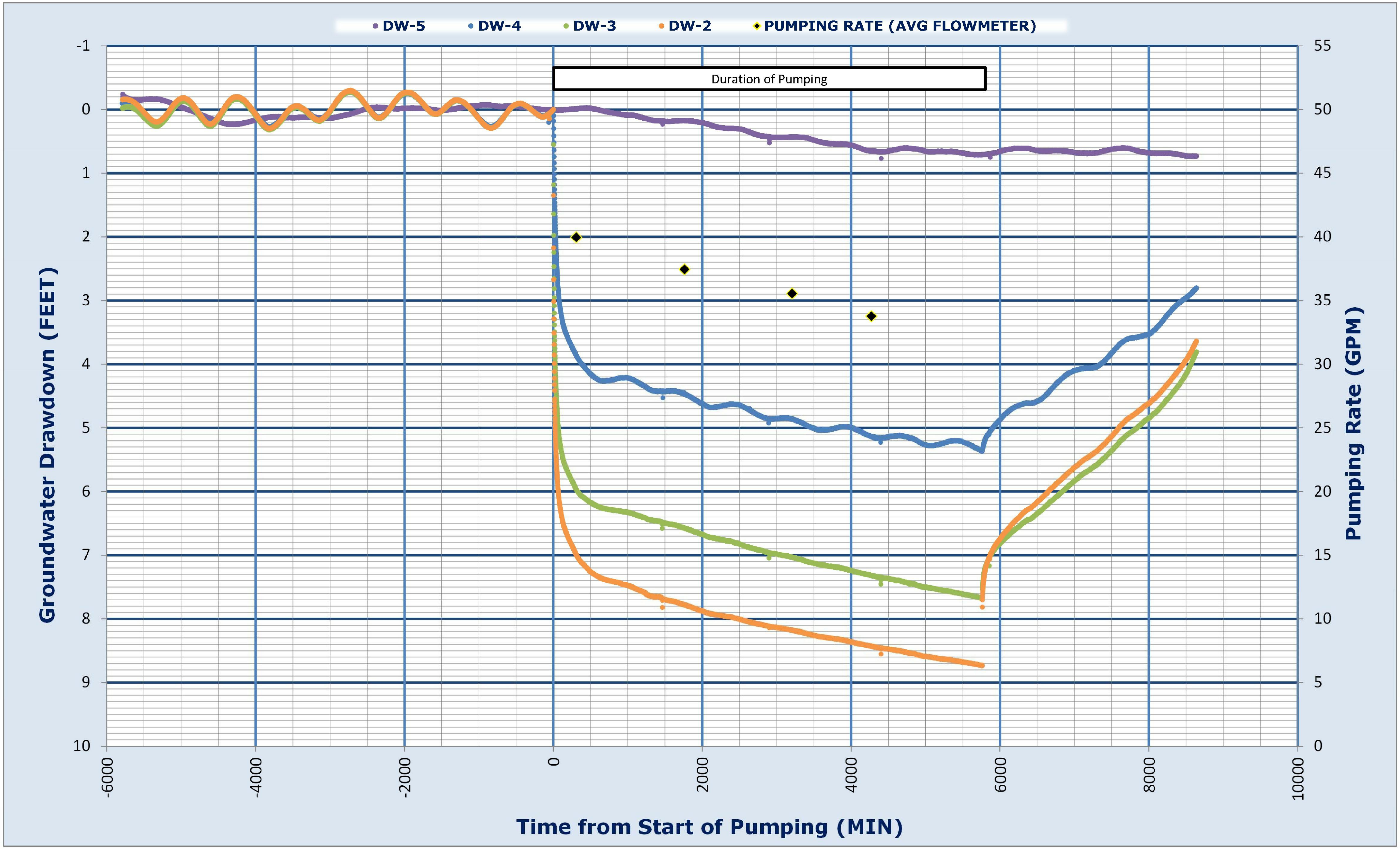
Appendix C
Water Level Data Plots – Deep Well Testing

Possum Point Pilot - Drawdown and Pumping Rate vs. Time - Deep Well Pumping Test Full Data Logger Record



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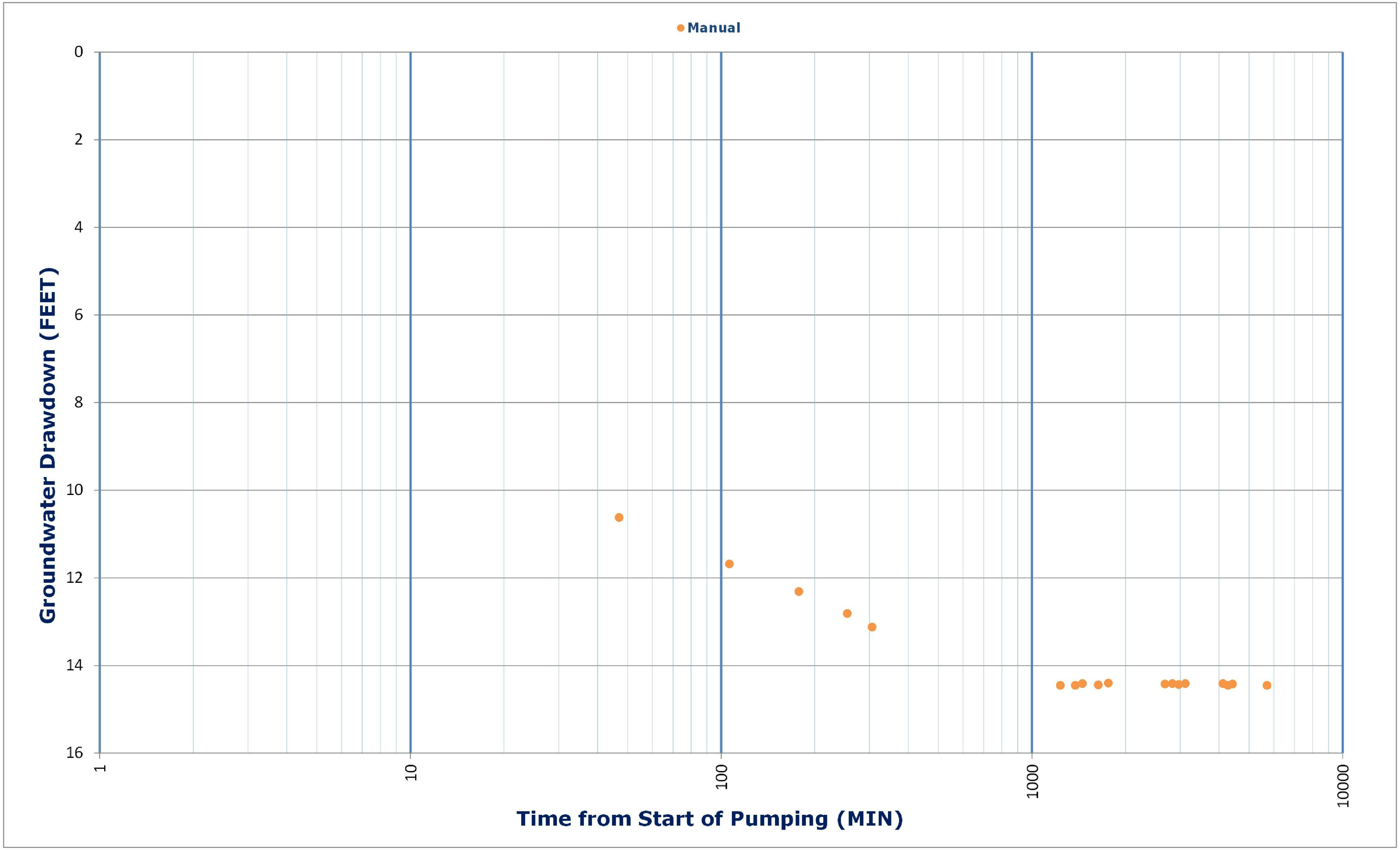
Possum Point Pilot - DW-1 Drawdown vs. Time - Length of Operation (Semi-Log)



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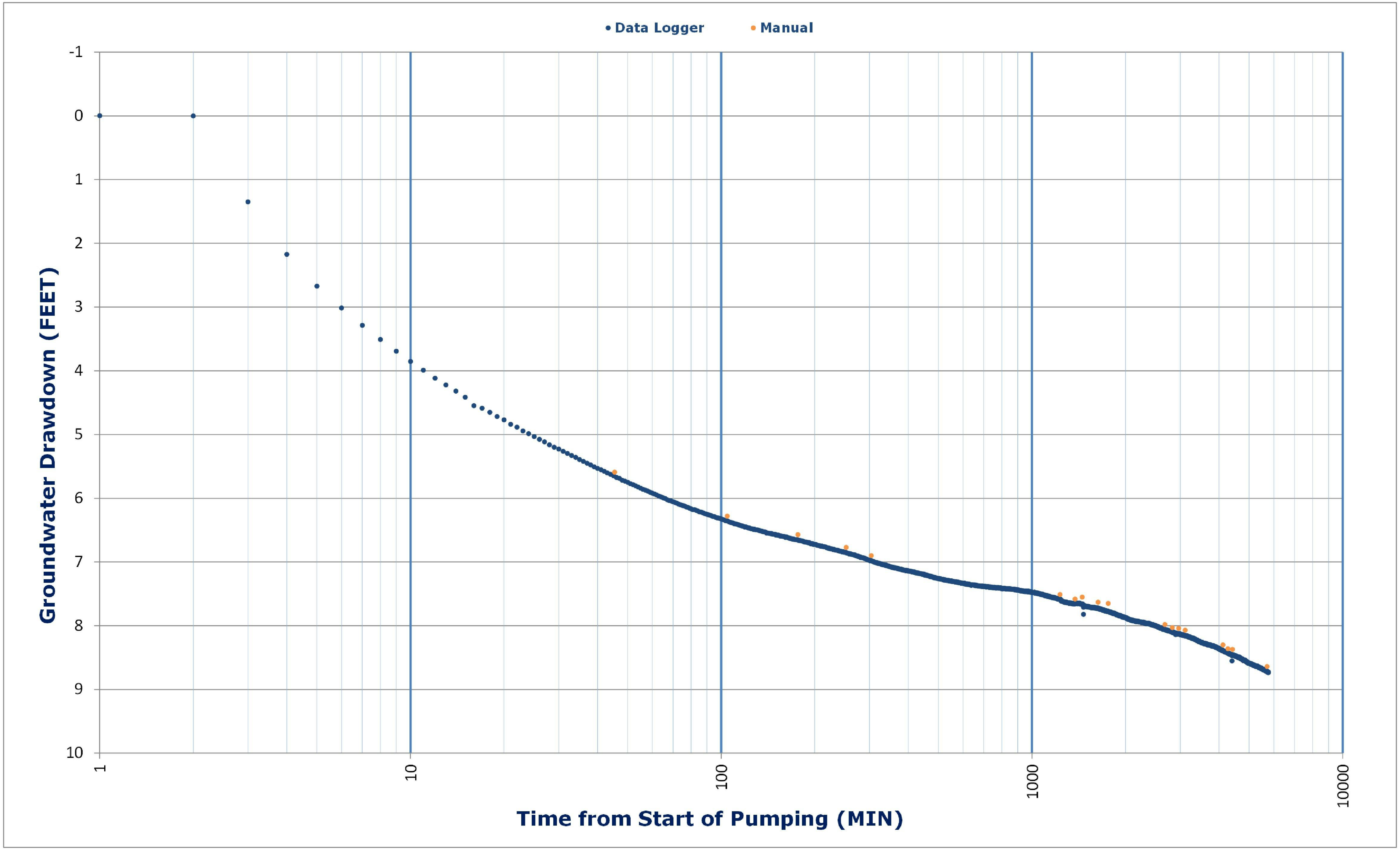
Possum Point Pilot - DW-2 Drawdown vs. Time - Length of Operation (Semi-Log)



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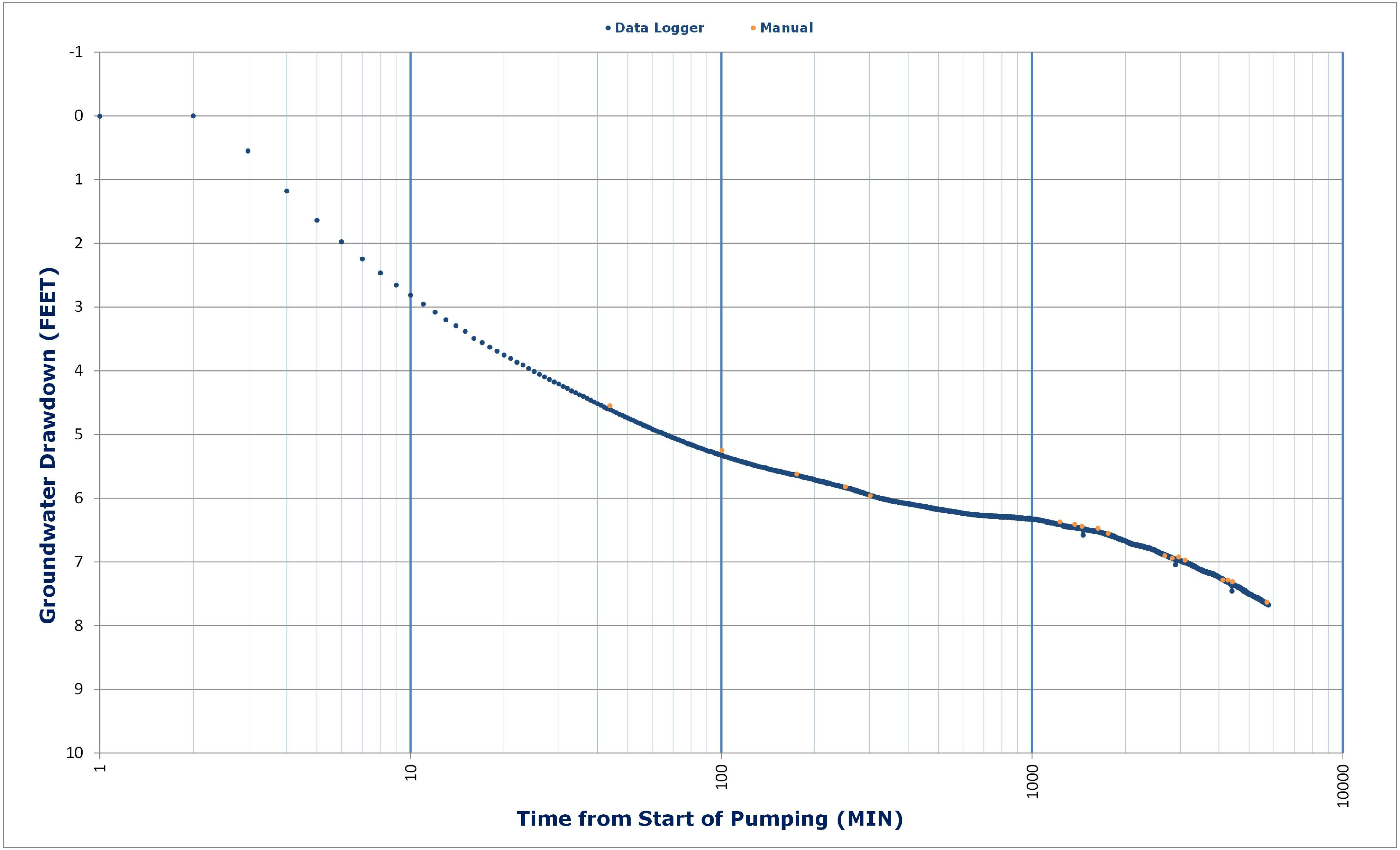
Possum Point Pilot - DW-3 Drawdown vs. Time - Length of Operation (Semi-Log)



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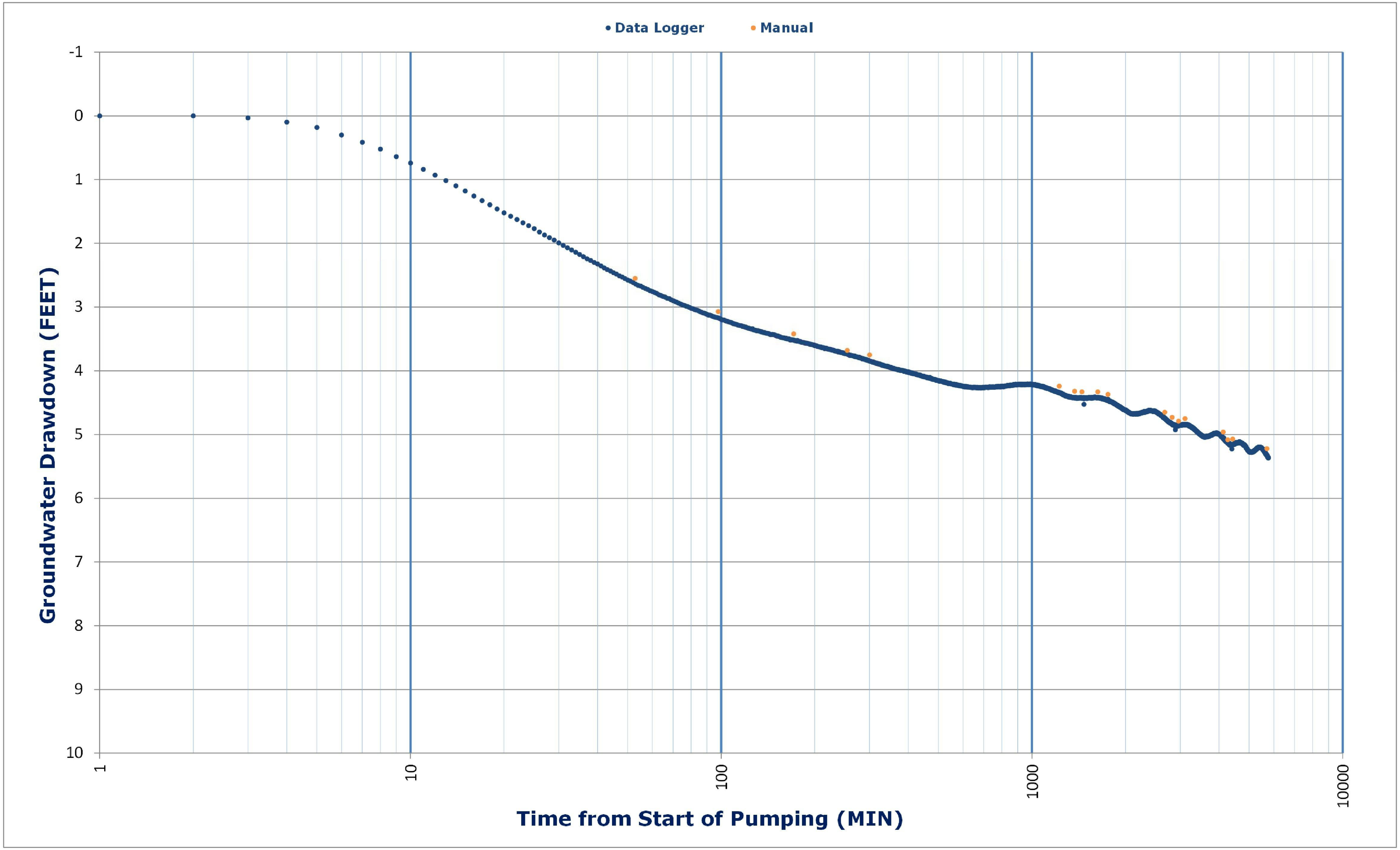
Possum Point Pilot - DW-4 Drawdown vs. Time - Length of Operation (Semi-Log)



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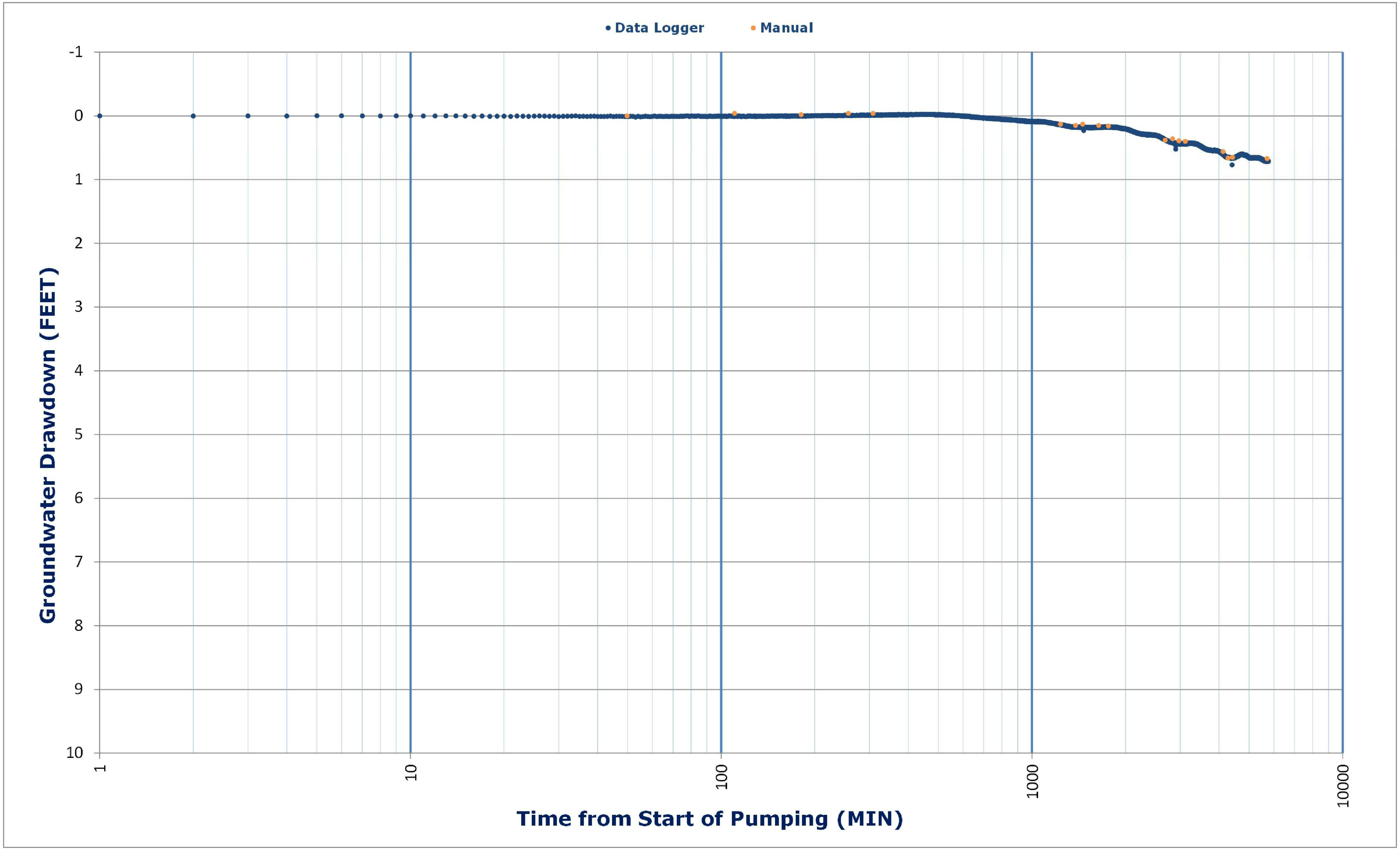
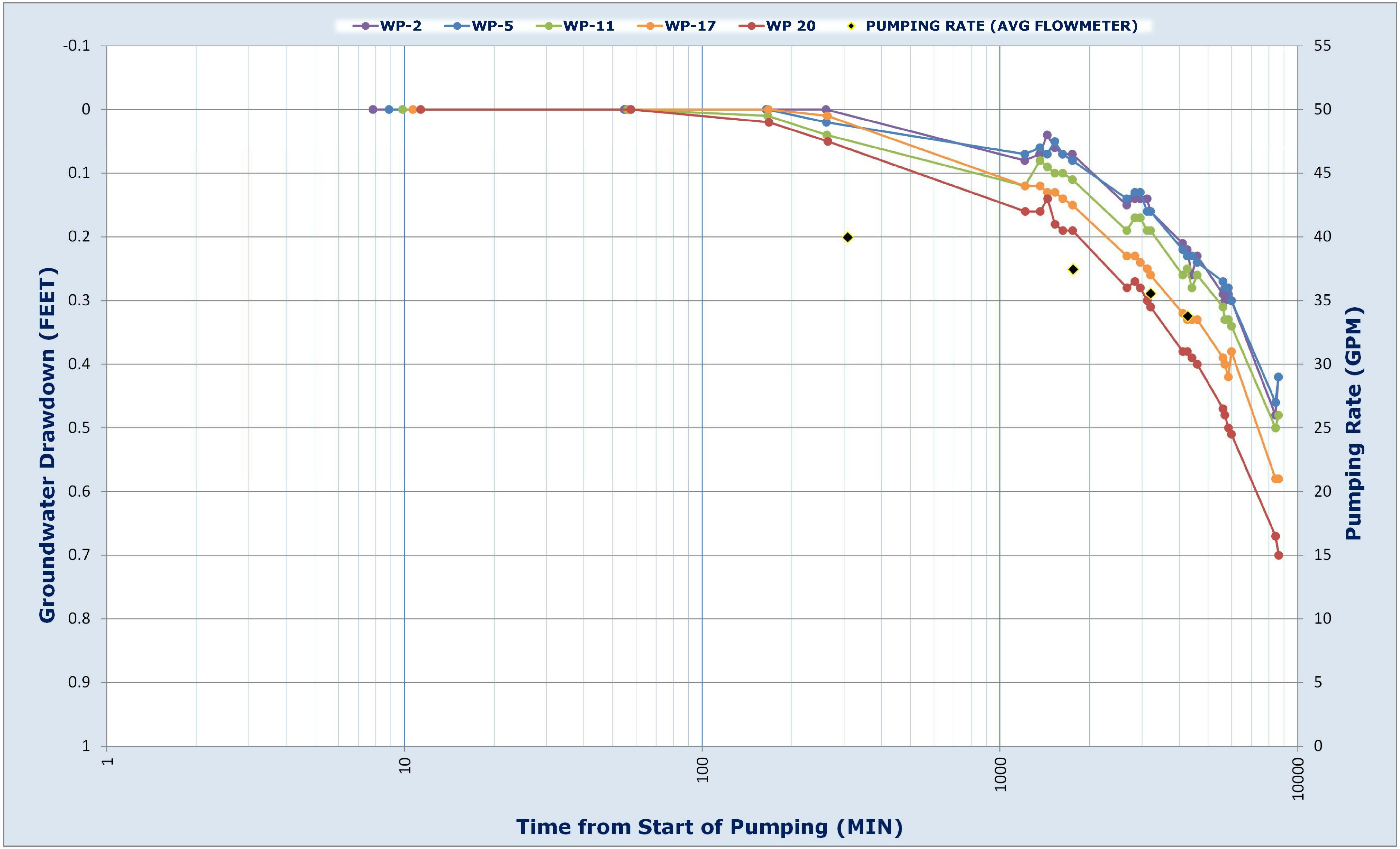
00011439

Possum Point Pilot - DW-5 Drawdown vs. Time - Length of Operation (Semi-Log)



MORETRENCH

Possum Point Pilot - Drawdown and Pumping Rate vs. Time - Deep Well Pumping Test Operation and Recovery (Semi-Log)



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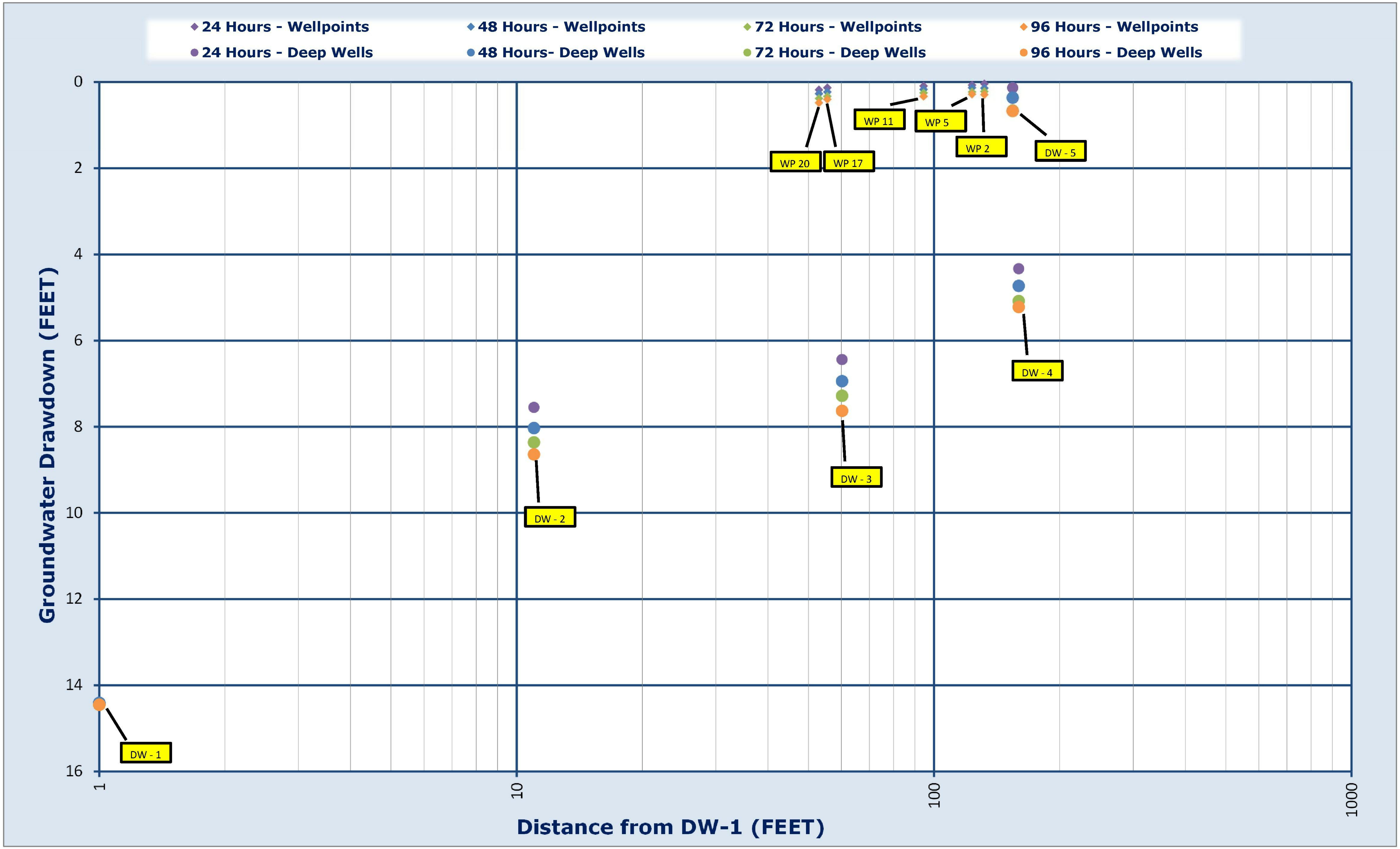
Possum Point Pilot - Drawdown vs. Distance from DW-1 (Semi-Log)



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Appendix D
Yield Test Data

Job Name: Possum Point Pilot
Job #: 61-4169
Test: Pre-Operation Yield Tests

YIELD TEST

BUCKET TESTS

Date	Location	Vacuum (in hg)	Duration (min)	Volume (gal)	Flow Rate (gal)	Average Flow Rate (gal)
5/4/2015	WP-1	27	10.28	5.00	0.49	0.45
		27	11.38	5.00	0.44	
		27	11.45	5.00	0.44	
5/4/2015	WP2	27	15.00	5.00	0.33	0.32
		27	15.60	5.00	0.32	
		27	15.83	5.00	0.32	
5/5/2015	WP-3	27	13.02	5.00	0.38	0.37
		27	13.10	5.00	0.38	
		27	14.08	5.00	0.36	
5/6/2015	WP-4	<10	63.22	5.00	0.08	0.08
5/6/2015	WP-5	<10	82.30	5.00	0.06	0.06
5/6/2015	WP-6	27	11.20	5.00	0.45	0.45
		27	11.35	5.00	0.44	
		27	10.98	5.00	0.46	
5/6/2015	WP-7	27	12.62	5.00	0.40	0.39
		27	12.83	5.00	0.39	
		27	12.85	5.00	0.39	
5/6/2015	WP-8	20	21.42	5.00	0.23	0.21
		20	28.00	5.00	0.18	
5/7/2015	WP-9	20	25.00	5.00	0.20	0.20
5/7/2015	WP-10	10	98.87	5.00	0.05	0.05
5/7/2015	WP-11	10	2.33	0.13	0.06	0.06
5/7/2015	WP-12	27	22.63	5.00	0.22	0.20
		27	26.62	5.00	0.19	
5/7/2015	WP-13	20	69.17	5.00	0.07	0.07
5/7/2015	WP-14	15	97.78	5.00	0.05	0.05
5/7/2015	WP-15	15	28.37	5.00	0.18	0.18
5/7/2015	WP-16	27	20.47	5.00	0.24	0.24
		27	20.73	5.00	0.24	
5/7/2015	WP-17	27	19.83	5.00	0.25	0.26
		27	18.58	5.00	0.27	
5/7/2015	WP-18	27	20.00	5.00	0.25	0.26
		27	18.62	5.00	0.27	
5/7/2015	WP-19	15	44.13	5.00	0.11	0.10
		15	53.75	5.00	0.09	
5/7/2015	WP-20	20	29.75	5.00	0.17	0.17
5/7/2015	WP-21	27	10.08	5.00	0.50	0.54
		27	8.63	5.00	0.58	
5/6/2015	PZ-01	<10	48.60	5.00	0.10	0.10
5/5/2015	PZ-02	<10	35.67	5.00	0.14	0.14
		<10	33.68	5.00	0.15	
5/5/2015	PZ-03	<10	88.10	5.00	0.06	0.06
5/5/2015	PZ-04	<10	23.70	5.00	0.21	0.21
5/5/2015	PZ-05	<10	23.65	5.00	0.21	0.21

N/A = Not Available

Appendix E
Tensiometer Data

Possum Point Pilot - Soil Suction (Centibars)

Time		TS1-5	TS1-10	TS1-15	TS2-5	TS2-10	TS2-15	TS3-5	TS3-10	TS3-15	TS4-5	TS4-10	TS4-15	Stage	
		Location													
5/8/2015	8:45	3	0	0	3	0	0	7	0	0	0	0	0	Static Testing	
5/9/2015	10:46	4	0	0	5	0	0	11	0	0	1	0	0	Day 1	Pumping Test
5/10/2015	11:54	11	0	0	11	0	0	12	0	0	6	0	0	Day 2	Pumping Test
5/11/2015	10:58	12	0	0	11	0	0	12	0	0	9	0	0	Day 3	Pumping Test
5/12/2015	10:38	13	0	0	12	0	0	13	0	0	11	0	0	Day 4	Pumping Test
5/13/2015	10:55	14	0	0	12	0	0	13	0	0	11	0	0	Day 5	Pumping Test
5/14/2015	11:20	14	0	2	12	0	0	14	0	0	12	0	0	Day 6	Pumping Test
5/15/2015	11:12	14	0	2	13	0	0	14	0	0	12	0	0	Day 7	Pumping Test
5/16/2015	12:55	14	1	4	13	1	0	14	0	0	13	0	0	Day 8	Pumping Test
5/17/2015	12:00	14	0	4	13	1	0	14	0	0	13	0	0	Day 9	Pumping Test
5/18/2015	14:15	14	1	4	13	2	0	15	0	0	13	0	0	Day 10	Pumping Test
5/19/2015	10:53	14	2	2	13	2	0	15	0	0	13	0	0	Recharge Testing	
5/21/2015	9:55	14	0	0	13	0	0	14	0	0	13	0	0	Recharge Testing	

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Appendix F
Pump Test Material Cut Sheets

SELF-JETTING WELLPOINTS

2" STYLE "D" STAINLESS STEEL

The self-jetting wellpoint was designed principally for use in sewer trench excavations where continued advancing of the wellpoint system requires constant reinstallation. The self-jetting wellpoint, by its design, uses water under pressure to advance its entry into the soil. Once in proper position, it is connected to the header system and becomes a vacuum wellpoint.

The 2" Moretrench American wellpoint is designed for dewatering all but the very pervious soils i.e., it is the self-jetting wellpoint for all soils. In conjunction with the Moretrench American jet chain, it provides increased diameter jet holes permitting a sand wick to be installed for drainage through layered soils. Average flow from the 2" self-jetting wellpoint under drawdown conditions of 15' is 20-25 GPM.

Moretrench American manufactures the 2" self-jetting wellpoint in two models.

Style "D" -- Self-jetting stainless Dutch weave
Style "D" -- Self-jetting ABS plastic wire wrapped.

2" Coupling -- A heavy guage malleable casting with accurately machined threads and a sand tight recess for the upper end of the screen cylinder.

1½" Drawdown Tube -- Enables the ground water to be drawn down to within a few inches from the bottom of the wellpoint screen.

Screen Cylinder -- Type 304 stainless steel construction is readily removable as a unit for cleaning, repair or replacement.

Filter Mesh -- Supported internally by the perforated screen cylinder. It is constructed from Type 304 stainless steel Dutch weave wire cloth, durable against damage during installation without requiring an outer protective covering. The filter mesh has fully unobstructed contact with the water-bearing soil. The MTA Dutch weave has an open area of approximately 45%.

Spacer -- Welded to the lower end of the drawdown tube to align the drawdown tube in the jet tip.

Moretrench American Ring Valve -- Prevents the jetting pressure from being lost by backwash through the screen. The full force of the jet stream erodes the soil in advance of the wellpoint.

Ball Seat -- Beveled internally to receive the ball valve after the jetting operation has ceased.

Polypropylene Ball Valve -- Floats up to the ball seat sealing the bottom of the wellpoint against the entry of sand after the wellpoint has been jetted in place.

Retaining Pin -- Keeps the ball valve in place during jetting.

Jet Tip -- Provided with cutting teeth for penetrating stiff clays and for displacing gravels.

Overall Length	--	38"
Diameter	--	3-1/8"
Weight	--	25 lbs

IRROMETER®

The WATERMARK Meter is a hand held device designed for reading WATERMARK sensors in the field. The digital readout displays the sensors' soil moisture status in centibars (cb) or kilopascals (kPa) of soil water tension. This value represents the energy a plant's root system uses to draw water from the soil. Whereas higher tension values indicate dryer soil, lower tension values indicate wetter soil. The meter's replaceable cable assembly has spring loaded clips for attaching to sensor leads. Users only need one meter to read any number of WATERMARK sensors. The meter comes in its own nylon case, padded and zippered for safe keeping when not in use.

Features:

- ***Large LCD display is easy to see in sunlight***
- ***Touch pad operating panel is simple to use and has a self test function***
- ***Quick release cable assembly is field changeable***
- ***Adjustable for soil temperature variations***

WATERMARK Digital Meter

Specifications –

COMPATIBILITY: The WATERMARK meter is designed to read WATERMARK sensors exclusively

POWER REQUIREMENTS: Self powered 9 VDC internal battery

MATERIALS: ABS plastic case with touchpad controls (tactile switches)

DIMENSIONS:

HEIGHT: 4.750 in. (121 mm) [5.25 in. (140 mm) including cable recepticle]

WIDTH: 2.75 in. (70 mm)

DEPTH: 1.0 in. (25 mm)

CABLE: 50 OHM coaxial cable [24 in. (.6 m)] with bayonet type connection (BNC) on the meter end and two alligator clips on the sensor end

DISPLAY: 0 –199 cb (kPa) of soil water tension

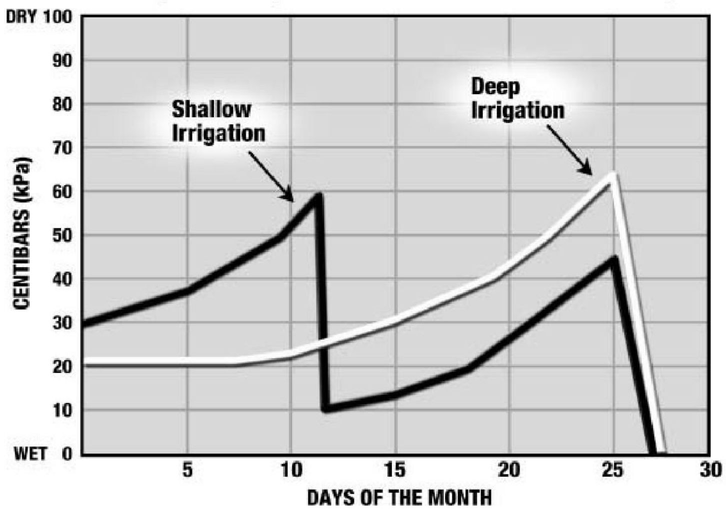
WARRANTY: One year

ORDERING INFORMATION: **Catalog #30-KTCD-NL — WATERMARK Digital Meter,** cable assembly and instructions in a zippered case.

OPERATING PRINCIPLE: The WATERMARK meter is designed to read all WATERMARK soil moisture sensors exclusively. These sensors have an output of 500 – 30,000 ohms of electrical resistance which is non-linear. The meter uses a solid-state alternating current resistance bridge meter for reading the sensors and converts the resistance value into centibars (cb) or kilopascals (kPa) of soil water tenson. The reading is displayed on an LCD screen [range 0 –199 cb (kPa)]. Soil temperature values can be input by the user to compensate for their effect on sensor reading.

SPECIFICATION INFORMATION: The soil moisture monitoring system shall incorporate Granular Matrix Sensors (GMS) to measure soil water tension. The sensors shall use a digital meter to read sensor values. The meter shall have a soil temperature compensation feature and self test functions on its tactile keypad. The meter shall be the model #30-KTCD-NL WATERMARK digital meter as manufactured by the IRROMETER Company, Inc. of Riverside, California.

Charting of Readings shows WHEN and HOW MUCH to Irrigate



This illustration shows how the WATERMARK meter can be used to improve irrigation scheduling efficiency. Starting in the lower left quadrant of the chart, it appears that for the first nine days of the month the sensor readings indicate normal drying of the soil. At the ten day mark the soil water tension for the shallow sensor (black line) starts to spike to approximately 60 cb (kPa) which prompts the user to initiate an irrigation cycle. This has an immediate impact on the shallow sensor as indicated by the drop to 10 cb (kPa) which may be close to field capacity (depending on soil type). Notice that the deep sensor (white line) saw little impact from the irrigation event because it was short in duration. This was planned by the irrigator to apply water to the shallow roots only and not reach the deeper portion of the root zone. On the twenty-fifth day both sensor readings peaked prompting the irrigator to run a longer duration irrigation cycle which was significantly more effective based on the steep drop of the sensor reading at both depths. The WATERMARK sensors and meter provide a very effective method of monitoring soil moisture trends and can help growers make informed scheduling decisions.

WATERMARK

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LITHO U.S.A. (5/10) #407

IRROMETER®

Model 200SS WATERMARK Sensor

shown here actual size

US Patent No. 7,705,616

In use since 1978, the patented WATERMARK sensor is a solid-state electrical resistance sensing device that is used to measure soil water tension. As the tension changes with water content the resistance changes as well. That resistance can be measured using the WATERMARK Sensor.

The sensor consists of a pair of highly corrosion resistant electrodes that are imbedded within a granular matrix. A current is applied to the WATERMARK to obtain a resistance value. The WATERMARK Meter or Monitor correlates the resistance to centibars (cb) or kilopascals (kPa) of soil water tension.

The WATERMARK is designed to be a permanent sensor, placed in the soil to be monitored and "read" as often as necessary with a portable or stationary device. Internally installed gypsum provides some buffering for the effect of salinity levels normally found in irrigated agricultural crops and landscapes.

Features:

- ***Proven stable calibration***
- ***Range of measurement from 0 to 239 cb (kPa)***
- ***Fully solid-state***
- ***Will not dissolve in soil***
- ***Not affected by freezing temperatures***
- ***Internally compensated for commonly found salinity levels***
- ***Inexpensive, easy to install and use***
- ***Compatible with AC or DC reading devices (specialized circuit required)***
- ***NO maintenance required***

Specifications –

MATERIALS: ABS plastic caps with stainless steel body over a hydrophilic fabric covered granular matrix.

DIMENSIONS – DIAMETER: .875 in. (22 mm)
LENGTH: 3.25 in. (83 mm)
WEIGHT: .147 lb. (.067 kg) – with 5 ft. lead

WIRE LEADS: AWG 20, 2 leads

WARRANTY: One year

ORDERING INFORMATION: **Catalog #200SS**
Standard length leads: **–5** = 5 ft. (1.5 m), **–15** = 15 ft. (4.5 m) –OR– **–_ _ _** = custom length.
Catalog #200SS-X = without leads.

WATERMARK Soil Moisture Sensors are shipped bulk unless specified to be in retail packaging (add **-PKG**).

APPLICATIONS INCLUDE –

• Irrigation Scheduling • Water Table Monitoring
• Leak Detection • Agronomy Research • Environmental Monitoring
• Anywhere you need to know when or if the soil moisture status is changing

OPERATING PRINCIPLE: The WATERMARK sensor is a resistive device that responds to changes in soil moisture. Once planted in the soil, it exchanges water with the surrounding soil thus staying in equilibrium with it.

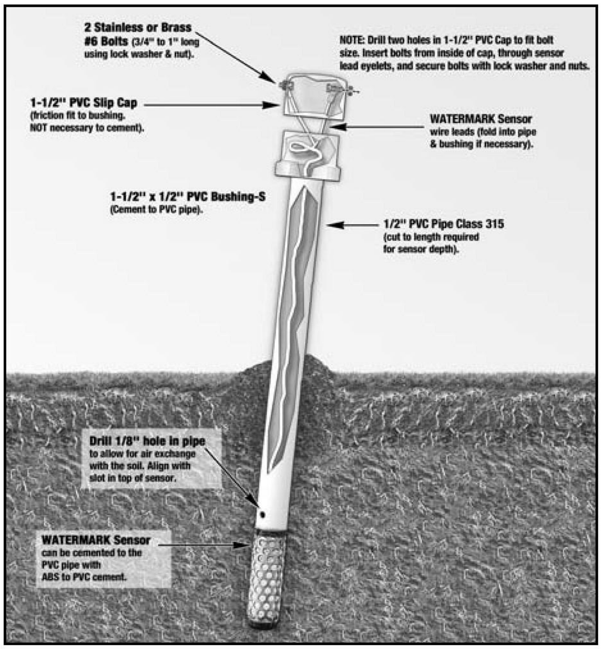
Soil water is an electrical conductor thereby providing a relative indication of the soil moisture status. As the soil dries, water is removed from the sensor and the resistance measurement increases. Conversely, when the soil is rewetted, the resistance lowers.

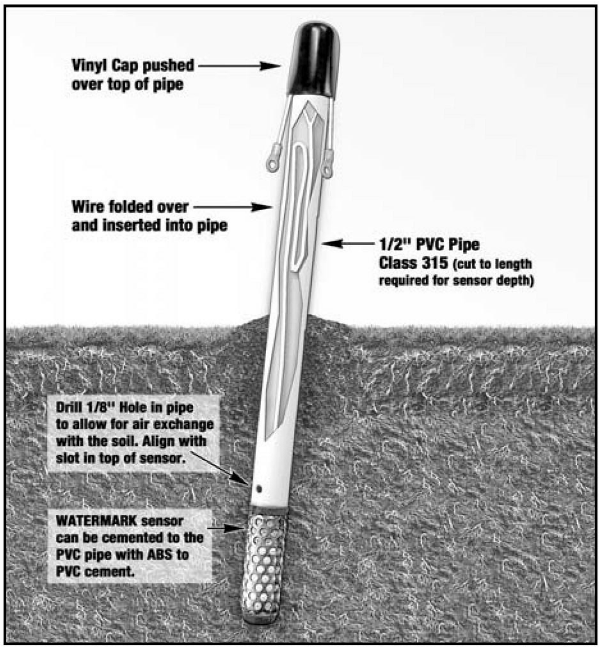
The WATERMARK sensor is unique in that it takes its resistive measurement within a defined and consistent internal matrix material, rather than using the surrounding soil as the measurement medium. This unique feature allows the sensor to have a stable and consistent calibration that does not need to be established for every installation.

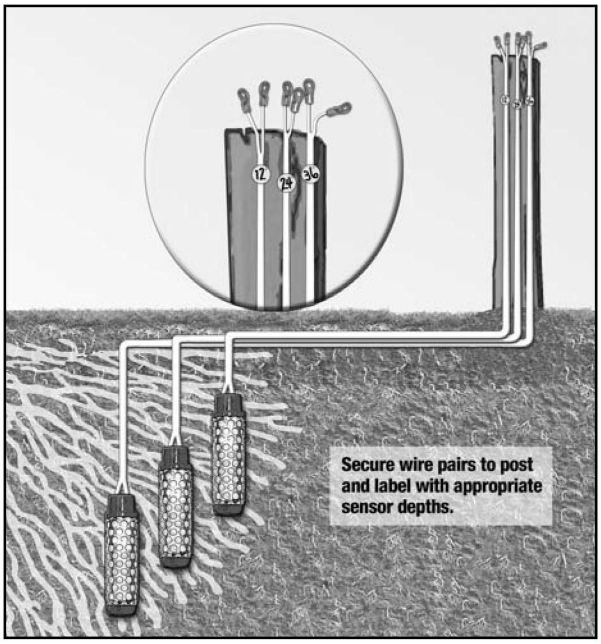
The relationship of ohm of resistance to centibars (cb) or kilopascals (kPa) of soil water tension is constant and built into the reading devices that are used to interrogate the sensor. The sensor is calibrated to report soil water tension, or matric potential, which is the best reference of how readily available soil water is to a plant. The WATERMARK sensor consists of stainless steel electrodes imbedded in a defined and consistent internal granular matrix material that acts like a soil in the way it moves water. This matrix is encased in a hydrophilic material that establishes good hydraulic conductivity with the surrounding soil and is held in place by a durable stainless steel perforated shell with plastic end caps.

SPECIFICATION INFORMATION: The soil moisture measurement device, or sensor, shall represent soil moisture status in units of soil water tension or matric potential, registering in centibars (cb) or kilopascals (kPa) when read with a compatible reading device. Its construction shall be of the Granular Matrix Sensor (GMS) type and require no on-site calibration or routine maintenance. It shall be durable, long-lasting, not subject to dissolving in a wet soil environment with an outer surface of stainless steel and ABS plastic. It shall be the WATERMARK sensor as manufactured by the IRROMETER Company, Inc. of Riverside, California.

Installation Examples:







WATERMARK

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